Wildland Fire

Preliminary Results of AQ Impact Analysis

and

Enhancements to the National Emissions Inventory

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Acknowledgements

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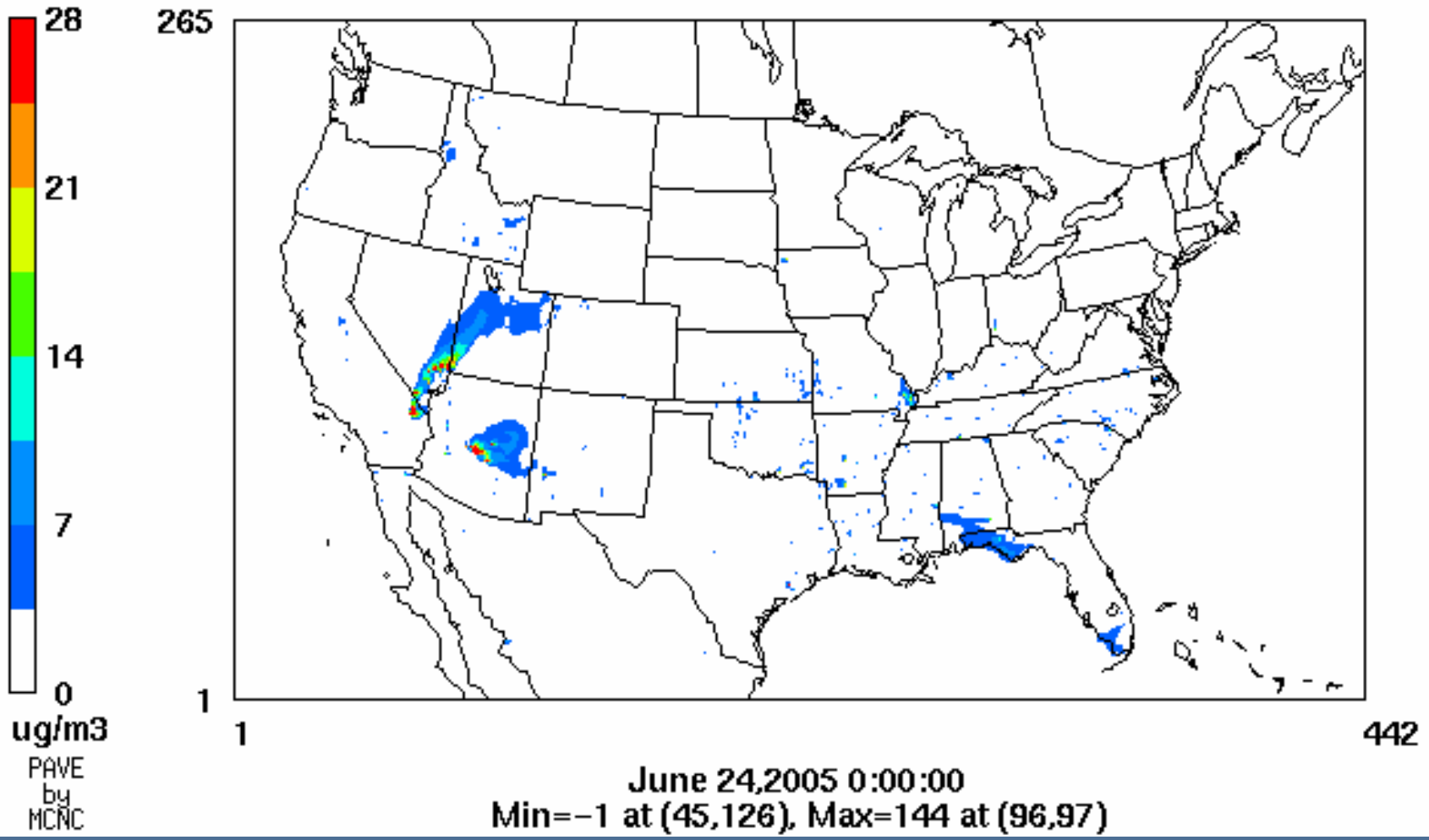
- Dave Randall (Air Sciences)
- Tom Moore & FEJF (WRAP)

What We'll Discuss

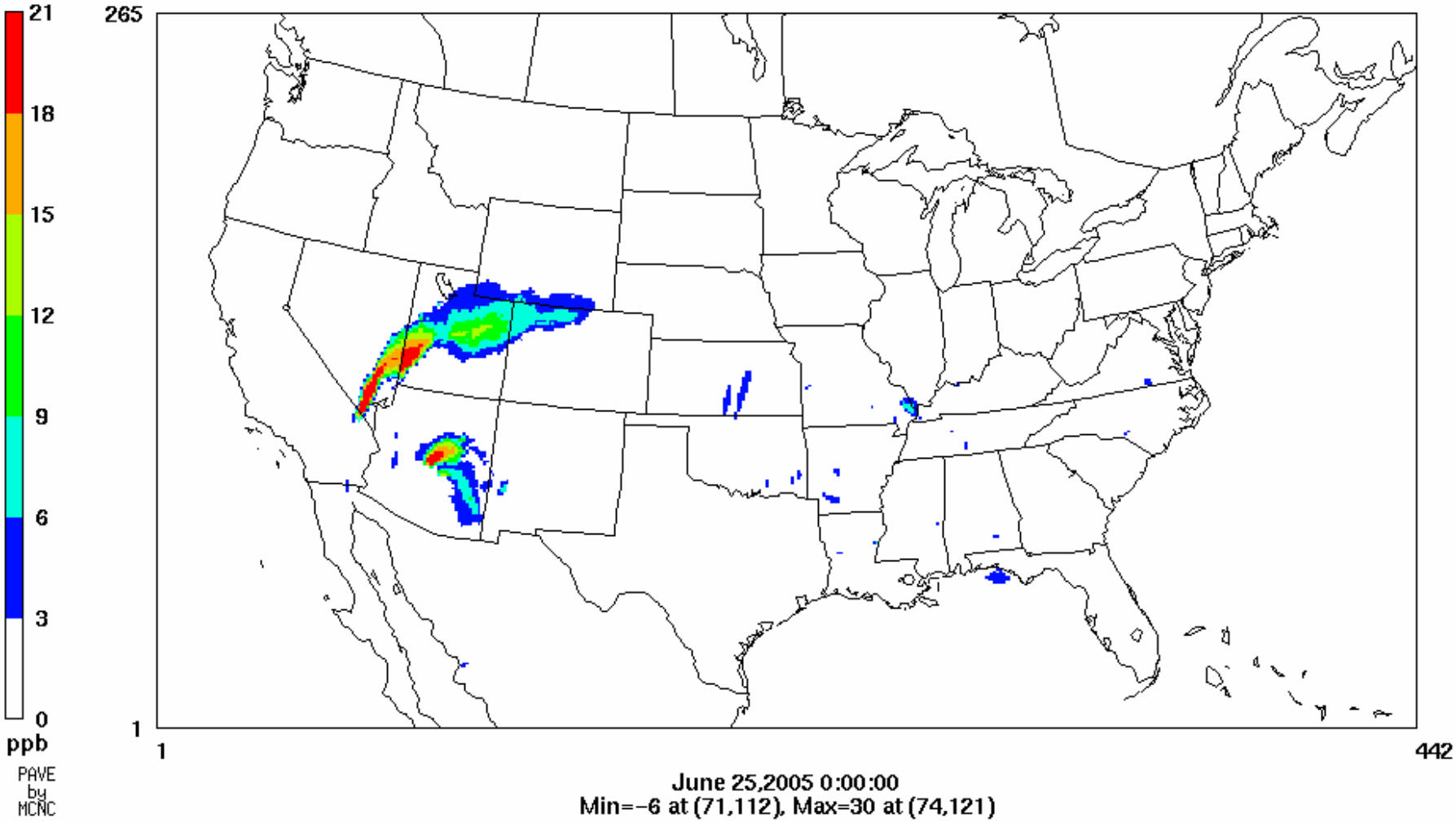
- Very preliminary results of analysis of fire impact on PM2.5 Air Quality
- Fire emissions in 2003 – 2006 and 2008
- EPA's new ***Events Module*** for Fires in the NEI

Difference in 24-hr Average PM2.5 June 24 Forecast

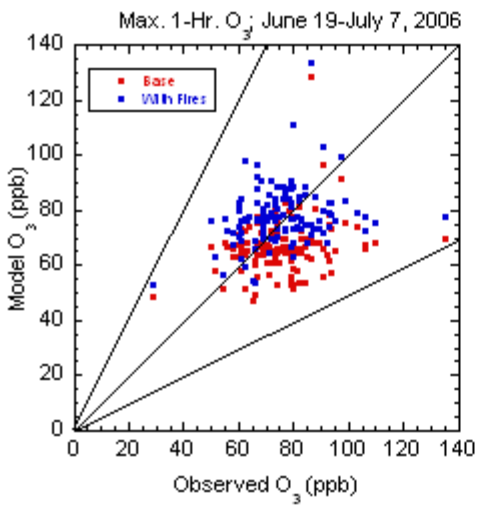
Fires – No Fires

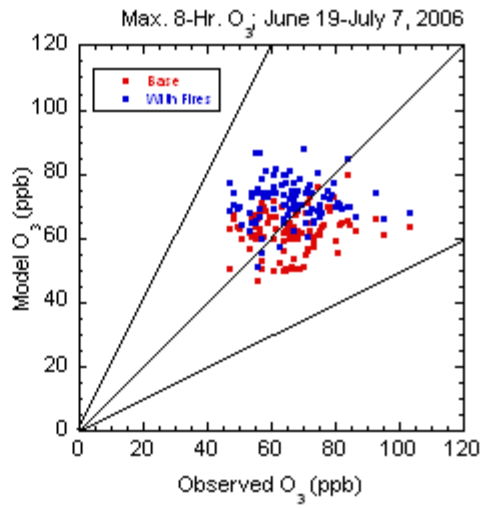


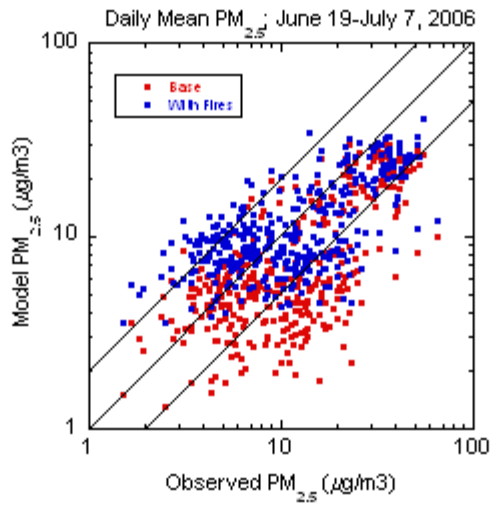
Difference in Max 8-hr Ozone for June 25 Forecast (Fires – No Fires)



Scatter Plots of Max 1-hr Ozone, Max 8-hr Ozone and daily Mean PM2.5 for June / July episode







Note: only model-obs. pairs selected where a fire impact was detected:

O3 (Fire-base)>4ppb
PM25 (Fire-base)> 2ug/m3

Legend
- With Fires
- Without Fires

Fire Impacts Using Ambient Data - Technical Approach

- Screen fire-days in contiguous US for multi-year period
  - Identify PM2.5 AQ monitors w/in *50* mi of each fire
  - Identify nearest met station, WS & WD for
    - each PM2.5 AQ monitor AND each fire location
  - Define
    - Upwind monitor ~ w/in *50* mi of fire AND in *180* deg sector UW
    - Downwind monitor ~ w/in *50* mi AND *90* deg sector DW of fire
- Identify fire-days with PM2.5 AQ monitor pairs:
  - w/ data AND w/in *50* miles upwind & downwind
  - Select monitor pairs with highest UW-DW difference if multiple monitors available on a given fire-day
- Account for “prior bias” between UW & DW monitors
- Summarize DW – UW differences

- Skunk Fire (Oregon)
  - July 25, 2002

Oregon
July 28, 2002
6 ug/m3
Tiller Fire
Timbered Rock Fire
40 mi
65 ug/m3
35 mi
57 ug/m3
© 2008 Tele Atlas
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Image State of Oregon
Image NASA
Google
lat 42.914047° lon -123.167566°
elev 1775 ft
Eye alt 173.71 mi

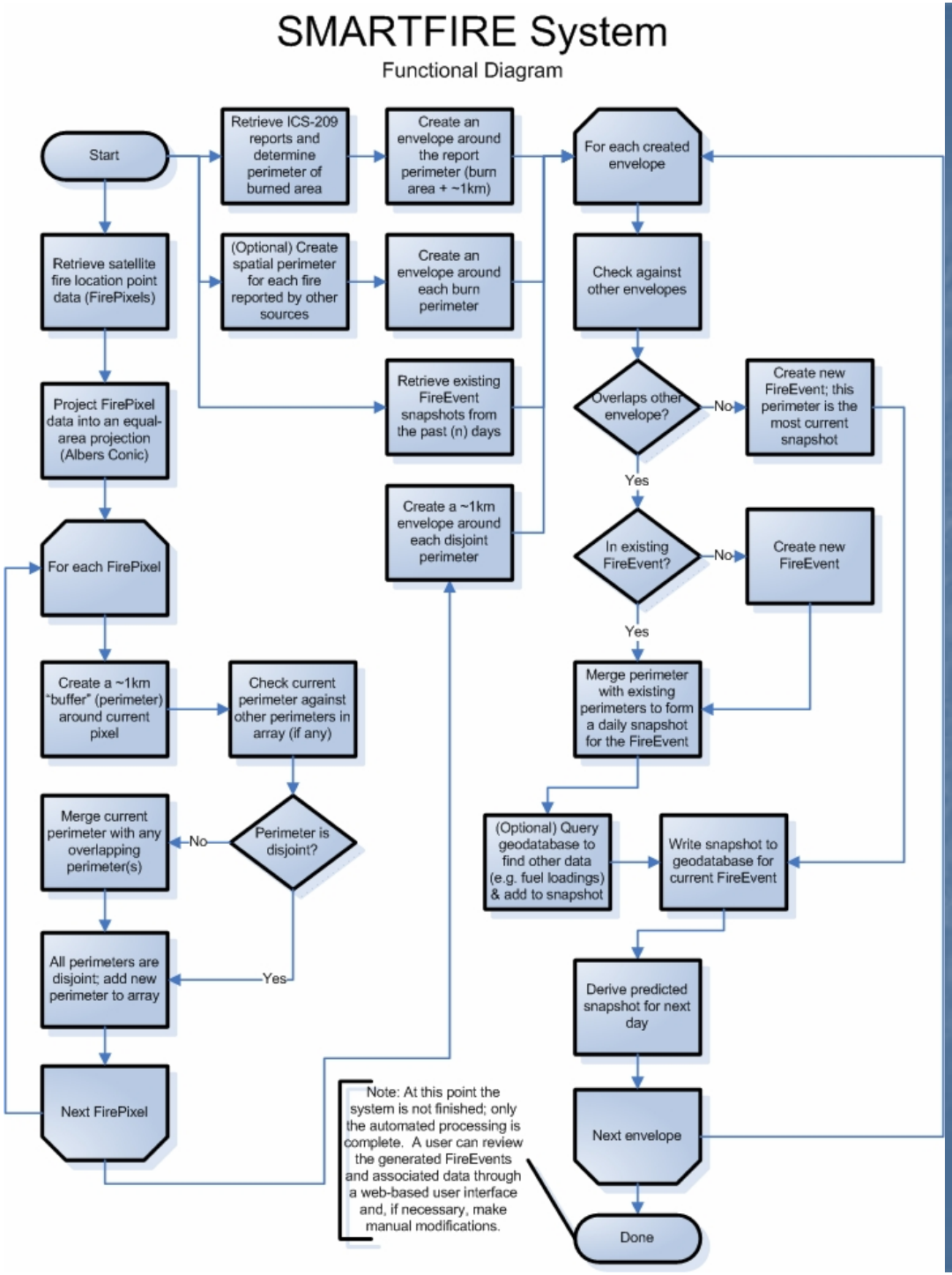
Improving Fire Data in the NEI

- **Pre – 2002** Fires treated as Non Point
  - Annual estimate, State/County geo-location
- **2002** Fires treated as Point Sources
  - Average daily emissions & 1st-day-of-fire location
  - Snapshot of 2002 – cost to redo prohibitive
- **2003-2006** Fires treated as Point Sources
  - Fire emissions & daily geo-location
  - 1st use of SMARTFIRE....

SMARTFIRE - A Hybrid Approach

Advantages, Limitations & Synergies

- **Satellite-derived Data**
  - **Available:** Fire location, size, date, daily progression
  - **R&D Needs:** Burn area, Thermal energy, Plume rise
  - **Limitations to Overcome:**
    - Detection limit (depends on intensity)
    - Cloud interference
    - Understory burns obstructed
    - Conversion of pixels to acres
- **Ground-report Databases**
  - Contains data on fires not detectable by satellite, but…
  - Errors and inconsistencies
- **Hybrid Satellite/Ground-report Data**
  - 1st Generation: 2003-2006 NEI AND SMARTFIRE
  - Needs: Incorporate more ground-report databases

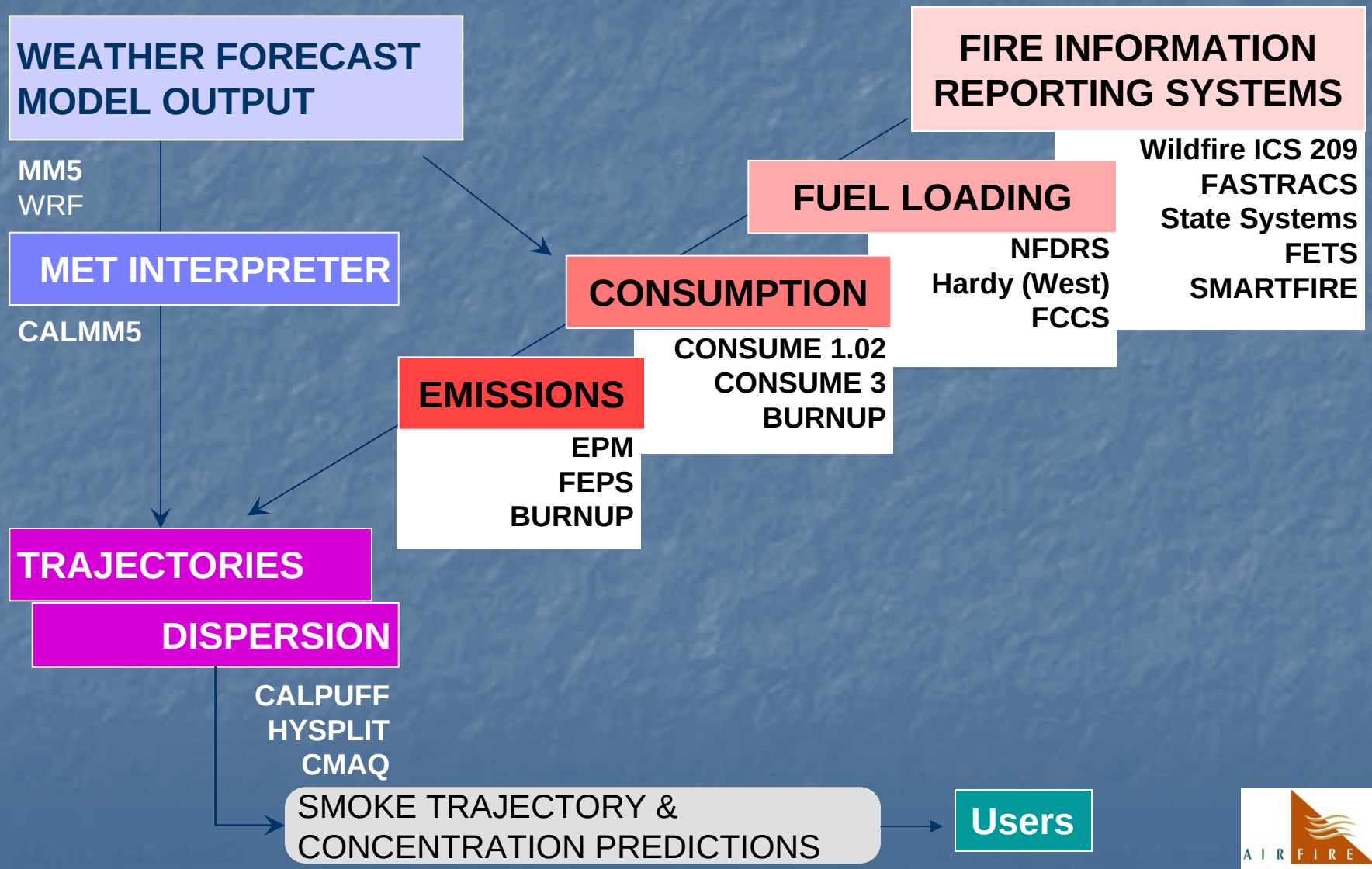


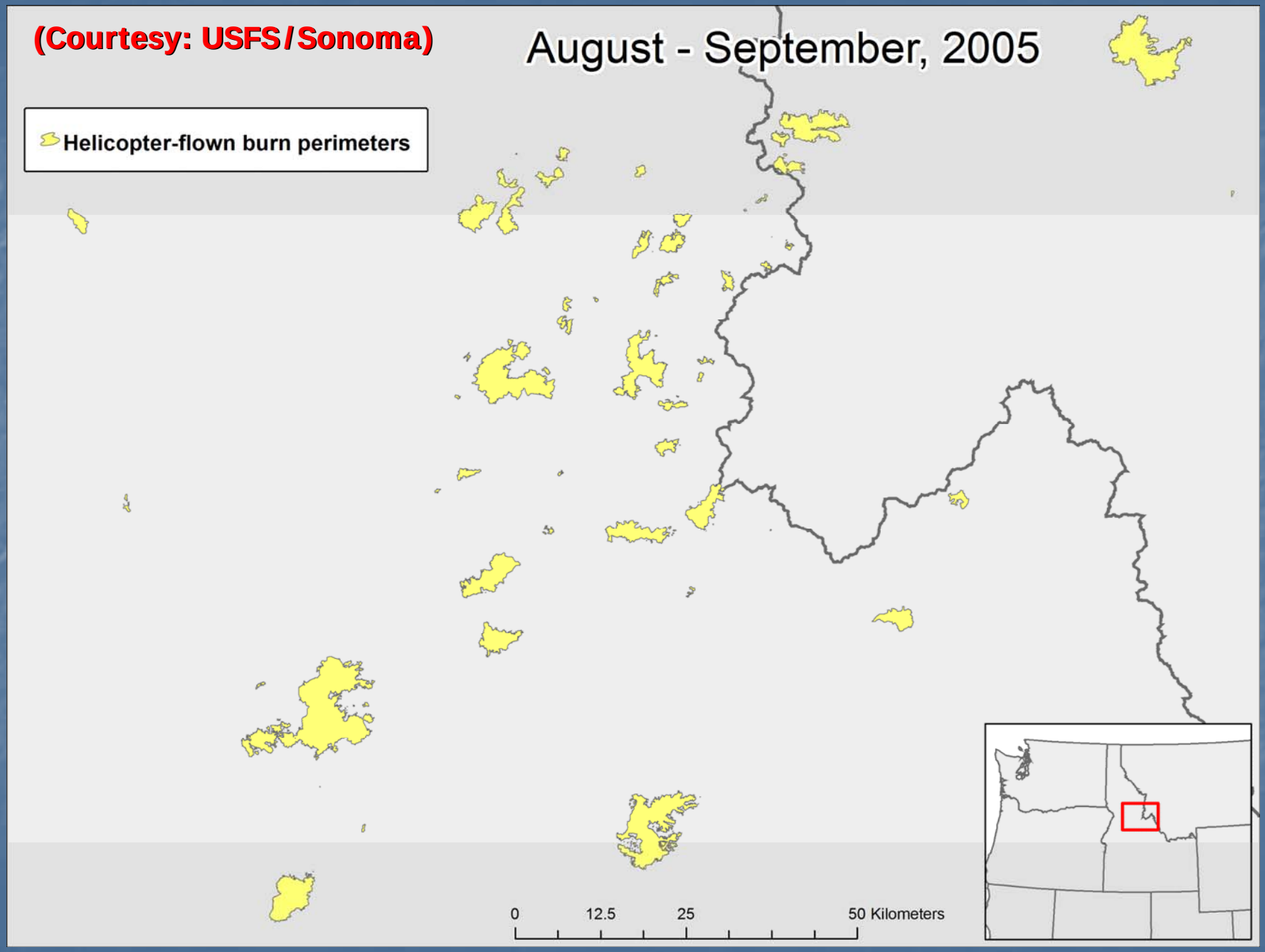
What is SMARTFIRE?

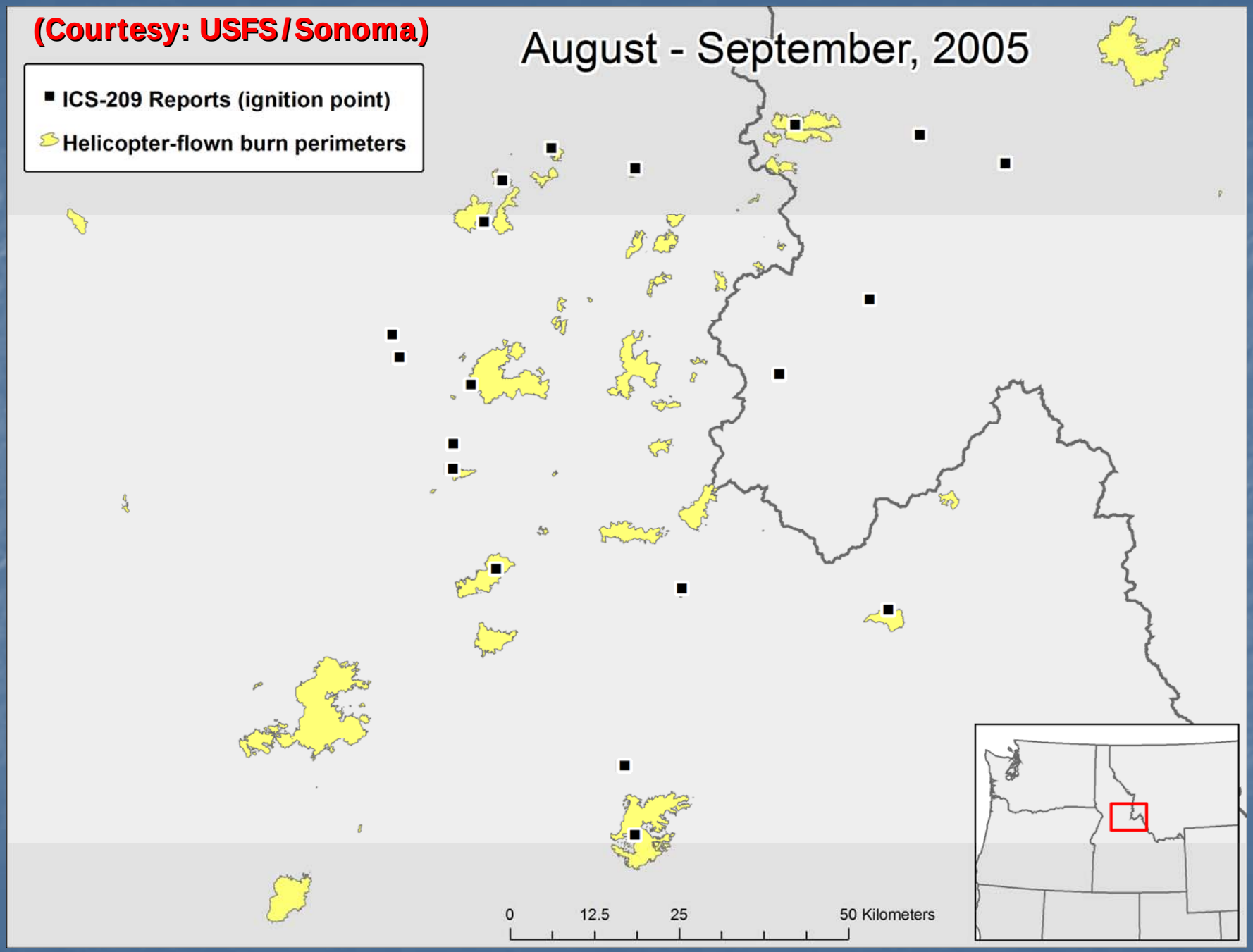
- SMARTFIRE uses NOAA Hazard Mapping System satellite fire detects along with ground reports from systems such as ICS-209 reports to create a reconciled fire information data feed.
- SMARTFIRE was developed by the USDA Forest Service AirFire Team and Sonoma Technology, Inc. under a grant from NASA.
- SMARTFIRE interfaces with the BlueSky framework to estimate daily, location specific fire emissions

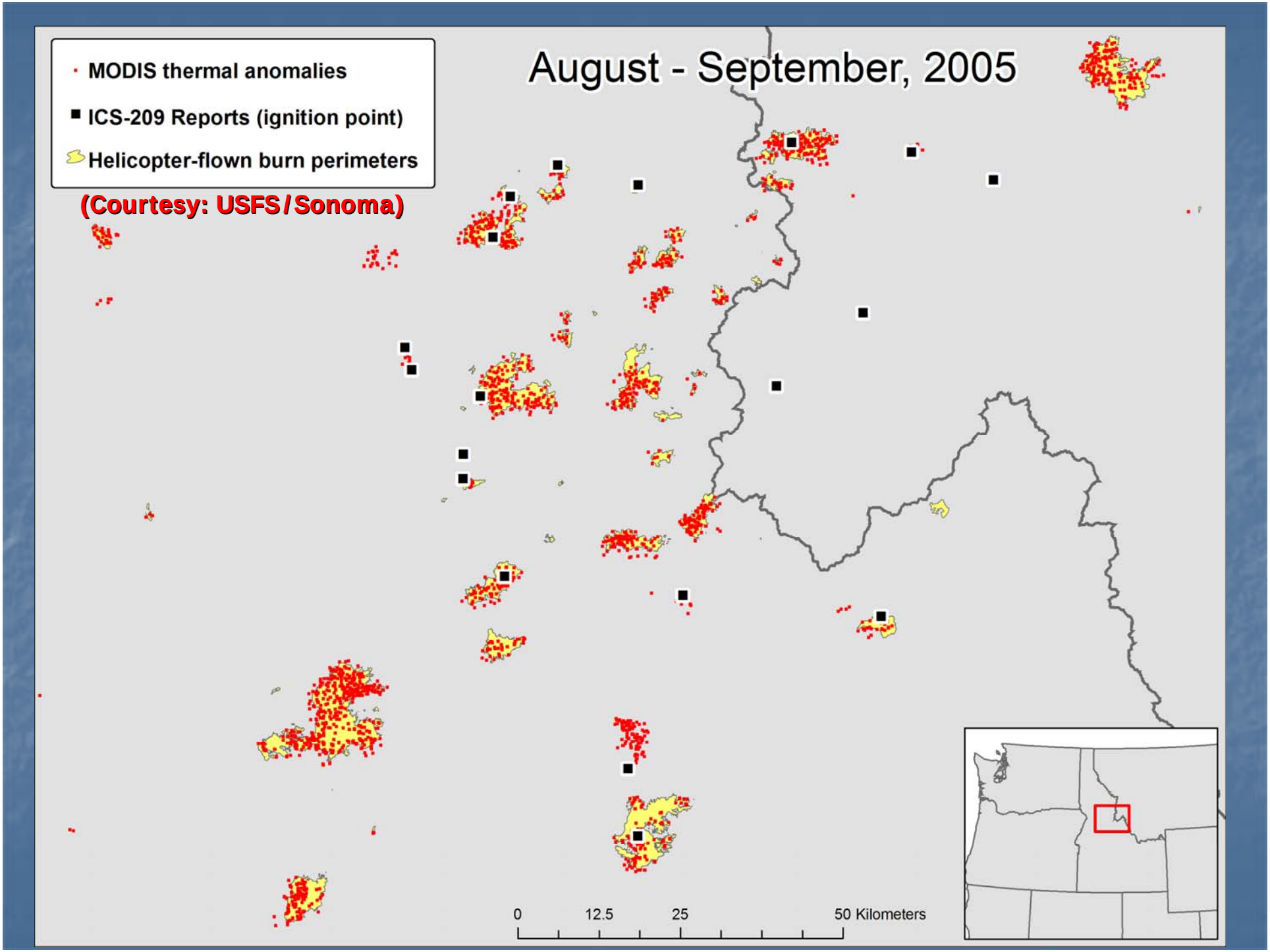
http://www.getbluesky.org/smartfire

BlueSky Framework: *An Evolving Toolset*




(Courtesy: USFS/Sonoma)
August - September, 2005
Helicopter-flown burn perimeters
0
12.5
25
50 Kilometers


(Courtesy: USFS/Sonoma)
August - September, 2005
ICS-209 Reports (ignition point)
Helicopter-flown burn perimeters
0
12.5
25
50 Kilometers


MODIS thermal anomalies
ICS-209 Reports (ignition point)
Helicopter-flown burn perimeters
(Courtesy: USFS/Sonoma)
August - September, 2005
0
12.5
25
50 Kilometers

2003 – 2006 Results (Acres)

Model	Year	PB/Unclass Acres	WF Acres	PB/Unclass + WF Acres
SmartFire	2003	5,500,480	2,685,580	8,186,060
SmartFire	2004	6,928,393	900,594	7,828,987
SmartFire	2005	8,632,472	1,770,942	10,403,414
SmartFire	2006	8,454,730	3,859,114	12,313,844
	Avg 03-06	*7,379,019*	*2,304,058*	*9,683,076*

Improving the NEI's Fire EI

- **Pre – 2002** Fires treated as Non Point
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  - 1st use of SMARTFIRE but...
  - lacks SLT input
- **2008** – Fires in ***Events Module*** in EPA's new EIS

What Information will be Stored in the Events Module?

Component Name	Required/ Optional	Description
Event	Required	Identifies the event, reporting land manager, management methods, and data sources.
Shape File (attach)	Optional	An attached set of geospatial shape files about the event.
Merged Events	Optional	Identifies discrete fires that merged into the current complex fire event.
Event Reporting Period	Required	The time period for which emissions are reported.
Event Location	Required	Identifies the location where the event occurred.
Geographic Coordinates	Required GC or GP	Describes geographic location of event using latitude/longitude coordinates.
Geospatial Parameters	Required GP or GC	Describes geospatial location of event using shape file information.
Event Emissions Process	Required	Identifies the SCC, fuels, fuel conditions, combustion characteristics, and activity that produced emissions.
Emissions	Required	Contains information on all the pollutants being reported for the location, process, and time period (Includes the units of measure, methods, emission factors and emissions as calculated
Attached File	Optional	References an attached file in the schema.

Key Dates for 2008 NEI Events Reporting (DRAFT)	
EPA instructions to S/L/Ts on providing fire dates & locations data to SMARTFIRE.	*Dec 31, 2008*
Deadline for S/L/Ts to provide fire dates & locations to SMARTFIRE in order for EPA to model emissions for the 2008 NEI.	*Jul 1, 2009*
EPA develops a national fire emissions inventory for the 2008 NEI using SMARTFIRE's satellite- and ground-based reports, includes those furnished by S/L/Ts.	*Jul 1 - Oct 1, 2009*
EPA's national fire emissions inventory is available on the EIS Gateway for S/L/T review.	*Oct 1, 2009*
SLT's submit alternative fire emissions inventory data to the EIS.	*Jul 1, 2009 - Jun 1, 2010*
Stakeholders review and comment on draft NEI.	*Jul 13 - Nov 1, 2010*

Post-2003-6 Fire EI Development

Next Generation of Hybrid Fire EI Methods

- **Fire Emissions Tracking System (FETS)**
  - WRAP States – on-line this summer
- **State Fire Tracking Systems (FAETS)**
  - e.g., Florida, North Carolina, Georgia, Pennsylvania
- **SMARTFire**
  - Automated integration of Events databases & Satellite data
- **Ongoing Tools Development & Research**
  - **BlueSky Framework Enhancements – 3.0 released**
  - **Improved area burned data from satellite observations (fire radiative power, statistical)**
  - **Multi-chimney, plume rise – MISR, Calypso**
  - **Near real-time emissions modeling is here in BETA!**

Summary

Evolution of Fire Emissions Estimation

- Pre 2002 ~ simplified, top-down
- 2002 ~ event-based, extensive “cleanup”
- 2003-6 ~ 1st generation hybrid
  - Satellites / event integration from ICS-209 database
- Future ~ 2nd generation hybrid
  - Multiple events databases
  - Improved algorithms to interpret information from satellites
  - Improved fire perimeter & area burned
    - Burned area analysis
    - Improved use of existing sensor spectra (acres/pixel)
  - Improved plume rise estimates

Thank you!

More Info:

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